

# Parent-only interventions in the treatment of childhood obesity: a systematic review of randomized controlled trials

H. Ewald<sup>1,2</sup>, J. Kirby<sup>1</sup>, K. Rees<sup>1</sup>, W. Robertson<sup>1</sup>

<sup>1</sup>Division of Health Sciences, Warwick Medical School, University of Warwick, Coventry CV4 7AL, UK

<sup>2</sup>Present address: Basel Institute for Clinical Epidemiology and Biostatistics, University Hospital Basel, Hebelstrasse 10, 3rd Floor, Basel CH-4031, Switzerland

Address correspondence to Hannah Ewald, E-mail: hannah.ewald@usb.ch

## ABSTRACT

**Background** An effective and cost-effective treatment is required for the treatment of childhood obesity. Comparing parent-only interventions with interventions including the child may help determine this.

**Methods** A systematic review of published and ongoing studies until 2013, using electronic database and manual searches. Inclusion criteria: randomized controlled trials, overweight/obese children aged 5–12 years, parent-only intervention compared with an intervention that included the child, 6 months or more follow-up. Outcomes included measures of overweight.

**Results** Ten papers from 6 completed studies, and 2 protocols for ongoing studies, were identified. Parent-only groups are either more effective than or similarly effective as child-only or parent–child interventions, in the change in degree of overweight. Most studies were at unclear risk of bias for randomization, allocation concealment and blinding of outcome assessors. Two trials were at high risk of bias for incomplete outcome data. Four studies showed higher dropout from parent-only interventions. One study examined programme costs and found parent-only interventions to be cheaper.

**Conclusions** Parent-only interventions appear to be as effective as parent–child interventions in the treatment of childhood overweight/obesity, and may be less expensive. Reasons for higher attrition rates in parent-only interventions need further investigation.

**Keywords** children, obesity

## Introduction

The high prevalence of childhood obesity is a significant concern for public health. Childhood obesity is an established risk factor for cardiovascular disease, as well as type 2 diabetes, respiratory diseases, musculoskeletal and psychological disorders.<sup>1,2</sup> In 1997, the World Health Organization (WHO) classified obesity as a global epidemic.<sup>3</sup> In England, the prevalence of overweight and obesity rose by 60% between 1994 and 1998 and by 150% between 1984 and 1998.<sup>4</sup> Although there has been a slight stabilization in recent years,<sup>5</sup> there is still a strong need for tackling childhood obesity. In 2011, 14.8% of boys and 12.6% of girls aged 2–15 years in England were reported to be overweight, and a further 16.6 and 15.9% respectively, were obese.<sup>6</sup>

Obesity has significant effects on both healthcare and economic costs.<sup>7</sup> The UK National Health Service currently

spends 5–6% of its budget on overweight and obesity-related problems,<sup>8</sup> equating to ~£5.1 billion per year. Interventions aimed at both preventing and treating obesity have been put into place.<sup>9,10</sup> As public health seeks to translate evidence-based research into clinical practice with the most cost-effective outcome, establishing the most cost-effective format for an intervention is a key priority.

Family-based interventions have been shown to be effective and are considered as the current best practice in the treatment of childhood obesity.<sup>9</sup> However, interventions that

H. Ewald, Researcher

J. Kirby, Research Fellow

K. Rees, Principal Research Fellow

W. Robertson, Associate Professor in Public Health

involve the whole family can be costly, in particular when not running at full capacity,<sup>11</sup> so increased attention is being paid to the possibility of parent-focused interventions. Parents play a large role in food choice and physical activity for their children and as such, targeting only parents could result in reduced intervention costs, if shown to be as effective. A recent review,<sup>12</sup> published whilst we were nearing completion of this review, investigated parent-only versus parent-child (family-focused) approaches for weight loss in obese and overweight children and included four trials. No significant differences in BMI Z-scores were shown from baseline to end-of-treatment between the conditions (three trials) or to end of follow-up (two trials).

This systematic review aims to add to the current knowledge in this area by including comparisons of parent-only groups with parent-child or child-only intervention groups for children aged 5–12 years. It includes searches up until June 2013 without any language limiters, thereby updating the Jull and Chen review<sup>12</sup> (completed searches August 2012). Furthermore, we include additional databases in our search and identify papers relating to intervention costs and ongoing trials (protocols) matching the inclusion criteria. In doing so, we highlight where current evidence is lacking and ensure that future investigations in this area will also take into consideration the most up-to-date studies.

## Methods

### Search methods

The literature search was carried out in July 2012 and updated in March 2013. The Centre for Reviews and Dissemination's guidance for undertaking reviews in healthcare guided the search.<sup>13</sup> Searches were made in the following electronic databases: Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, CINAHL, PsychInfo and ASSIA. MeSH headings (or their equivalent) and text word terms were used, and key words were related to child, parent and overweight/obesity. The search strategy for Medline can be found in the Appendix. Reference lists of short-listed studies and systematic reviews were screened to identify further studies. Trial registers were searched to identify ongoing trials (metaRegister of controlled trials ([www.controlled-trials.com/mrct](http://www.controlled-trials.com/mrct)), Clinicaltrials.gov ([www.clinicaltrials.gov](http://www.clinicaltrials.gov)) and the WHO International Clinical Trials Registry Platform (<http://apps.who.int/trialsearch/>)).

Two authors independently screened the titles/abstracts from the database searching for potential relevance, retrieved the full text and then independently assessed short-listed studies for formal inclusion/exclusion. To be included,

studies had to fulfil each of the following criteria: (i) target children aged 5–12 years who are overweight or obese; (ii), include an intervention targeting parents only, for the treatment of overweight/obese children; (iii) have a comparison intervention targeting children, with or without parents; (iv) include an outcome measure of adiposity of the child (e.g. BMI, waist circumference, percentage fat); (v) be a randomized controlled trial (RCT) with at least 6-month follow-up. No limiters on language have been applied.

### Risk of bias

The quality of studies was evaluated by assessing the risk of bias using the Cochrane Collaboration's tool.<sup>14</sup> Two authors independently judged five domains (selection bias, detection bias, attrition bias, reporting bias and other bias) and ranked their judgement as low, high or unclear risk of bias. A sixth domain, performance bias (i.e. blinding of participants and personnel), was not assessed as it is impossible to blind either study participants or those delivering the intervention for behavioural interventions. For 'other bias', we looked at study power and the reported sample size calculations. Protocol papers were consulted where available. Disagreements were resolved by consensus and a third author was consulted where necessary.

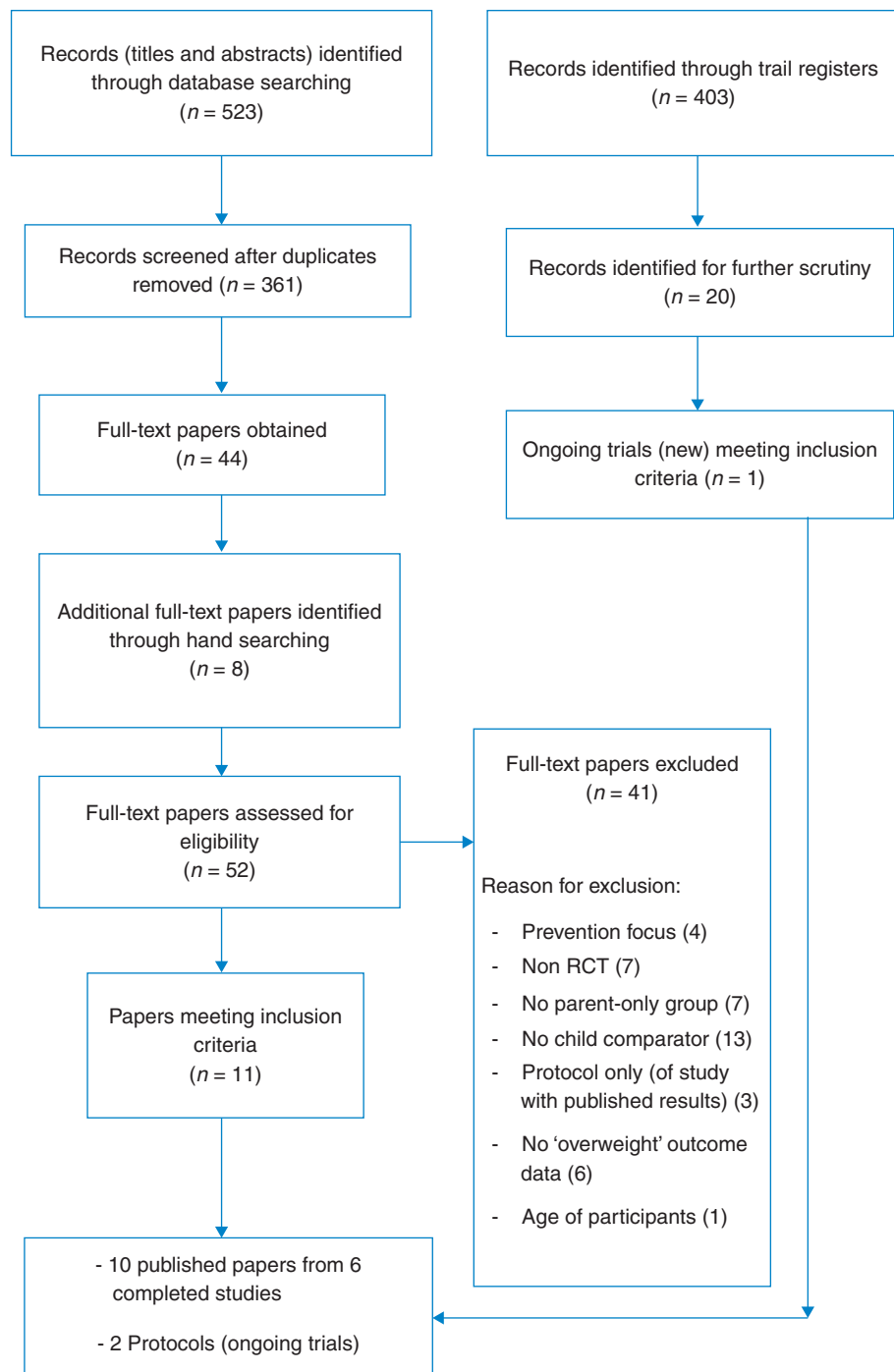
## Results

The electronic database search identified 523 titles and abstracts for screening, and those that were clearly irrelevant were excluded at this stage. Fifty-two short-listed papers were identified for retrieval of the full text. The search for ongoing trials on trial registry databases yielded 403 hits, resulting in the inclusion of a protocol for an additional ongoing trial from ClinicalTrials.gov.<sup>15</sup> In total 8 studies (from 12 papers) met the inclusion criteria for the review, of which 6 were completed studies and 2 were protocols for ongoing trials.<sup>15,16</sup> Reasons for excluding papers are presented in Fig. 1.

### Study characteristics of completed studies

Table 1 presents the characteristics of the eight studies (in case of several publications on one study, the main paper is cited first). Of the six completed studies, two were carried out in Israel,<sup>17,18</sup> two in USA,<sup>19,20</sup> one in Switzerland<sup>21</sup> and one in Australia.<sup>22</sup>

Parent-only interventions were compared with interventions targeting both parent and child in five studies<sup>15,18,20–22</sup> and with child-only interventions in two studies.<sup>17,22</sup> All studies reported effectiveness, one study being an equivalence trial (testing if one treatment is more or less as effective as another,<sup>21,27</sup> one a non-inferiority trial (testing if one



**Fig. 1** PRISMA flow diagram of study selection process.

treatment is therapeutically not worse than a reference treatment<sup>19,27</sup> and the other four were superiority trials (testing superiority of one treatment over the other.<sup>27</sup> One study also reported data on costs.<sup>25</sup>

One study included children aged 8–14 years, and was included because of the overlap with the target age range of the 5–12 years. All child participants were overweight or

obese defined as either >20% overweight or above the 85th BMI percentile. Extremely obese children (BMI Z-score > 4) were excluded in one study.<sup>22</sup> Study sample sizes ranged from 37 to 165 participants, including a total of 466 children. All studies included male and female children and both parents, apart from one study, which was restricted to only mothers due to recruitment issues.<sup>21</sup>

**Table 1** Characteristics of included studies

Study	Study country/ setting and study design	Participants baseline characteristics by treatment group (group differences)	Intervention (details, length, length of follow-up)	Comparison group (details)	Primary Outcome Measure Points
Published papers					
Golan <i>et al.</i> <sup>17</sup>	Israel	PO: $n = 30$ (18F, 12M), 8.9 + 0.3 years	PO specific: 14 × 1 h group sessions; in last 7 months also	CO specific: 30 × 1 h group sessions; individual support available	Month 0 Month 12
Golan <i>et al.</i> <sup>23</sup>	N/a	CO: $n = 30$ (19F, 11M), 9.2 + 0.2 years	5 × 15 min individual sessions with the whole family	Prescription of a 6.3 MJ/day (1500 kcal/d) diet Energy intake ↓; Exercise ↑; Control food stimuli;	Month 24* Month 36*
Golan and Crow <sup>24</sup>	Arm 1) PO Arm 2) CO Superiority trial	%-overweight as mean ± SD: PO: 39.6 ± 3.0 (20.1– 95.5) CO: 39.1 + 3.8 (20.3– 102.2) No significant between group differences at baseline.	Sedentary lifestyle ↓; create opportunities for physical activity; fat content ↓; Exposure to food stimuli ↓; parenting skills, coping with resistance Overall intervention content: Nutrition education; Cognitive restructuring; eating behaviour modification; problem solving	Self-monitoring; Use of social support	Month 96* (7 years after termination)
Golan <i>et al.</i> <sup>18</sup>	Israel N/a Arm 1) PO Arm 2) PC Superiority trial	PO: 10F, 7M, 8.75 + 1.9 years PC: 10F, 10M, 8.7 + 2 years BMI PO: 24.2 (SD 3.0) BMI PC: 24.3 (SD 3.6) Mean %-overweigh PO: 47.0 (SD 22.1) PC: 48.5 (SD 18.1) No difference between groups in sex and BMI after allocation	PO specific: PO intervention but changes intended for entire family Overall intervention duration: 16 × 1 h support and education group sessions over 6 months Additional 40–50 min individual appointments 1 ×/month for each family in both groups during those 6 months Overall intervention content: Healthy eating patterns; daily physical activity ↑; sedentary behaviour ↑ For parents: coping techniques (with regard to an authoritative feeding style (adults determine which foods are offered, children determine the amount eaten)	PC specific: Child and parent attend group together—materials of PO group but child adapted	Month 0 Month 6 Month 18
Munsch <i>et al.</i> <sup>21</sup>	Switzerland University and hospital/out-patient	PO: 15F, 9M, 10.6 ± 1.5 years PC: 17F, 12M, 10.3 ± 1.4	PO specific: Cognitive behavioural therapy (CBT) for mother only	PC specific: CBT for both mother and child	Month 0 End of treatment (exact timing)

Continued

Table 1 Continued

Study	Study country/ setting and study design	Participants baseline characteristics by treatment group (group differences)	Intervention (details, length, length of follow-up)	Comparison group (details)	Primary Outcome Measure Points
	clinic Arm 1) PO Arm 2) PC Equivalence trial	years %-overweight (mean $\pm$ SD): PO: 62.4 $\pm$ 27.2, $n$ = 21 PC: 55.4 $\pm$ 17.9, $n$ = 28 No significant differences between groups	Children received PMR in parallel session (control condition for children—same frequency and duration as CBT for children in PC arm) Overall intervention duration: 10 weekly 120-min sessions; 6=monthly aftercare sessions Overall intervention content: Nutrition and eating behaviour, physical activity, social competences, body concept, relapse prevention		unclear) 6-month follow-up (exact timing unclear)
Janicke <i>et al.</i> <sup>20</sup> Janicke <i>et al.</i> <sup>25</sup>	USA (rural) Community Arm 1) PO Arm 2) PC Arm 3) WLC Superiority trial (PO and PC over WLC)	(Numbers completing all 3 assessments) PO: 12F, 14M, 11.0 years PC: 15F, 9M, 11.4 years WLC: 16F, 5M, 11.0 years BMI-Z PO: 2.015 BMI-Z PC: 2.160 BMI-Z WLC: 2.133 No significant differences between groups	PO specific: Behavioural PO intervention. Parents encouraged meeting with children outside of the intervention to set goals. Overall intervention duration: 8 weekly group sessions a 90 min Then biweekly group sessions for next 8 weeks a 90 min Overall theoretic basis: Modified version of stoplight diet Treatment manuals developed for this project. Pre-specified design and methods Overall intervention content: Dietary habits; food monitoring; physical activity $\uparrow$ ; Behavioural strategies: self-monitoring and goal setting	PC specific: Parent and Children participated in separate parallel groups. Parents' content similar to PO group. Brought together at end of session to develop dietary goals for the week. WLC specific: Intervention only received after final follow-up assessment	Month 0 Month 4 Month 10
Okely <i>et al.</i> <sup>22</sup> Collins <i>et al.</i> <sup>26*</sup>	Australia University: 'Community' Arm 1) PO Arm 2) CO Arm 3) PC	PO: $n$ = 42 (26F, 16M), 8.2 $\pm$ 1.2 years CO: $n$ = 63 (38F, 25M), 8.3 $\pm$ 1 years PC: $n$ = 60 (33F, 27M), 8.1 $\pm$ 1.2 years	PO specific: Parent-centred programme on changing family eating behaviours Overall intervention duration: 1 weekly 2 h face-to-face session for 10 weeks	CO specific: Child-centred programme on promotion of physical activity/reduction of sedentary behaviour PC specific: Combination of PO and CO	Month 0 Month 6 Month 12 Month 24*

Boutelle <i>et al.</i> <sup>19</sup>	Superiority trial (of PC over PO/CO)	BMI-Z PO: 2.8 (0.6) BMI-Z PC: 2.8 (0.7) BMI-Z CO: 2.8 (0.7) N/a	Overall intervention content: Homework activities; 3-month relapse prevention programme		
	USA University Arm 1) PO Arm 2) PC Non-inferiority trial	PO: 20F, 20M, 10.8 + 1.3 years PC: 28F, 12M, 10.1 + 1.2 years BMI-Z PO: 2.29 (0.38) BMI-Z PC: 2.25 (0.34) BMI: PO: 30.48 (6.08) BMI: PC: 28.26 (4.64) Groups were 'roughly equivalent' at baseline (significance tests not done)	PO specific: Behavioural treatment delivered to parents only. Overall intervention duration: PO parallel to PC groups, 1 h each session, unsure of number of sessions Overall intervention content: Standardized manuals; traffic-light diet; physical activity; behaviour change skills; parenting skills	PC specific: Parent group (same materials as PO) and parallel child group (materials adapted to child) Parent-child dyads met with interventionist to set family goals	Month 0 Month 5 Month 11
Study	Study country/ setting and study design	Estimated recruitment Estimated completion date	Intervention (details, length, length of follow-up)	Comparison group (details)	Primary outcome Measure Points
Ongoing trials Janicke <i>et al.</i> <sup>16</sup>	USA Rural (community) Arm 1) PO Arm 2) PC (behavioural intervention) Arm 3) PC (educational control) Superiority trial (PC and PO over PC educational control)	240 parent-child dyads June 2014	PO specific Behavioural treatment delivered to parents only. Parents instructed to meet with their children at home and work together to set goals based on their previous progress Overall intervention duration: 8 weekly group meetings (90 min) Then 4 bi-weekly sessions across 16 weeks Then one group session per month (months 5-12), with exception of month 9, when participants will attend two group sessions. Overall intervention content: Dietary habits; Modified version of stoplight diet; food monitoring; physical activity ↑; Behavioural strategies: self-monitoring and goal setting	PC specific (behavioural) Parallel parent and child groups. Parents' content identical to PO group. Children start with review of achieving dietary and physical activity goals, then exercise or game component, then with group leaders prepare and sample healthy snack. Brought together with parents at the end of session to set lifestyle behaviour goals for the week. PC specific (educational control) 21 group meetings (each 90 min) addressing key aspects of nutrition, physical activity and health promotion. Children will participate in a group physical activity and sample healthy snacks. No behavioural elements included for either parent or child.	Month 0 Month 12 Month 24
Boutelle and Cotton <sup>15</sup>	USA Arm 1) PO	150 parent-child dyads March 2015	PO specific: Behavioural treatment delivered to parents	PC specific: Parallel parent and child groups. Treatment includes	Month 0 Month 6

Continued

Table 1 Continued

Study	Study country/ setting and study design	Participants baseline characteristics by treatment group (group differences)	Intervention (details, length, length of follow-up)	Comparison group (details)	Primary Outcome Measure Points
	Arm 2/ PC Non-inferiority trial		only. Overall intervention duration: 12 weekly meetings and bi-monthly meetings during months 4 and 5. 1hr each session including weigh-ins. Overall intervention content: Behaviour change; weight loss; healthy eating; physical activity	same skills and techniques as PO-group, but information delivered to both parent and child. Treatment length, session schedule, treatment content and follow-up assessments are same as PO.	Month 12 Month 18

PO, parent-only group; CO, child only group; PC, parent-child group; WLC, wait-list control; CBT, cognitive behavioural therapy; PMR, progressive muscle relaxation.

The interventions were delivered over periods of 10 weeks to 7 months, with sessions ranging from 1 to 2 h (Table 1). The session content comprised nutrition, physical activity and behaviour modification or cognitive behavioural therapy. The parent-only arms received similar content and duration of intervention as the comparator arms. The overweight or obese children of the parents from the parent-only arm did not receive any direct intervention, apart from one study in which children received progressive muscle relaxation training (PMR) in order to deliver comparable attention to the children in the parent-child group.<sup>21</sup>

Some studies used several outcome measures for change in children's overweight: three measured excessive body fat in percent overweight, three studies used BMI Z-score, two used BMI and one BMI-percentile. Among all groups, the children's average baseline percent overweight ranged from 39.1 to 62.4%, BMI Z-score from 2.015 to 2.8 and BMI from 28.26 to 30.48 kg/m<sup>2</sup>. For parents, four studies measured BMI<sup>19-21,28</sup>; one study measured 'percentage overweight'<sup>17</sup> and one study did not measure parental weight.<sup>22</sup> Baseline parental BMI or percentage overweight was not statistically different between groups in four studies,<sup>17,20,21,28</sup> and deemed to be 'roughly equivalent' in the study by Boutelle *et al.*<sup>19</sup> The mean parental BMI at baseline was in the overweight category (BMI ≥ 25) in the study by Munsch *et al.*,<sup>21</sup> and in the obese category (BMI ≥ 30) in the other three studies.<sup>19,20,28</sup>

Assessment of bias

The assessment of bias in the six completed studies is shown in Fig. 2. Overall, the studies were at unclear risk of bias due to non- or underreporting. One study was regarded as being at high risk of bias for allocation concealment as families were notified of their group assignment at the pre-treatment assessment.<sup>20</sup> Two studies were regarded as at high risk of bias for incomplete outcome data as there was high and differential loss to follow-up between the comparison groups, with higher losses in the parent-only interventions.<sup>17,21</sup>

Other potential biases examined as part of the review process included sample size and the possibility of small study effects.<sup>29-31</sup> The sample sizes at baseline were small and ranged from 12 to 72 participants per allocated group. Three studies reported sample size calculations,<sup>18,21,22</sup> in 2 of these the target recruitment was not met.<sup>21,22</sup> Measures to minimize contamination bias were not reported in any of the included studies.

Change in child BMI

Between-group analysis

We performed a narrative synthesis of the data from the six completed studies as there was substantial heterogeneity



	<div>Random sequence generation</div> <div>Allocation concealment</div> <div>Blinding of outcome assessment</div> <div>Incomplete outcome data</div> <div>Selective reporting</div> <div>Other bias</div>					
Golan <i>et al.</i> <sup>17,23,24</sup>	?	?	?	–	+	?
Golan <i>et al.</i> <sup>18</sup>	?	+	+	+	+	?
Munsch <i>et al.</i> <sup>21</sup>	?	?	?	–	+	?
Janicke <i>et al.</i> <sup>20</sup>	?	–	?	?	?	?
Okely <i>et al.</i> <sup>22</sup> , Collins <i>et al.</i> <sup>26</sup>	+	?	+	?	+	?
Boutelle <i>et al.</i> <sup>19</sup>	+	?	?	+	+	?

Key	
–	High risk of bias
+	Low risk of bias
?	Unclear risk of bias

Fig. 2 Risk of bias assessment for included studies.

regarding the comparison groups and outcome measures reported which precluded meta-analysis. For each study 'between group' changes in measures of overweight, which compare parent-only interventions with either child-only or parent-child interventions, are presented in Table 2. The two superiority trials by Golan *et al.* have shown significantly greater reductions in the degree of overweight from the parent-only groups in comparison with the child-only<sup>17</sup> and parent-child<sup>18</sup> groups. The two other superiority trials showed mixed results: in Okely *et al.*'s study<sup>22</sup> the BMI Z-score showed a significantly greater reduction at 12 months for the parent-only group compared with the child-only group (mean difference  $-0.22$ ; 95% CI  $-0.38$  to  $-0.06$ ) but no difference in comparison with the parent-child group (mean difference  $0.07$ ; 95% CI  $-0.08$ – $0.23$ ). The difference in BMI Z-score between the parent-only and child-only groups was not statistically significant by Month 24 (mean difference  $-0.17$ ; 95% CI  $-0.34$ – $0.01$ ).<sup>26</sup> The other superiority trial, by Janicke *et al.*,<sup>20</sup> showed no significant difference between the parent-only and the parent-child groups at 4 and 10 months (mean difference in BMI Z-score at Month 4:  $0.061$ ; 95% CI  $-0.039$ – $0.162$ ,  $P = 0.23$ ). Neither Munsch *et al.*,<sup>21</sup> examining equivalence, nor Boutelle *et al.*,<sup>19</sup> conducting a non-inferiority trial, found any difference between the parent-only and parent-child groups in the reduction of percentage overweight or BMI percentile, respectively (Table 2).

Dropout rates from the interventions varied widely between 3 and 72% (Table 2). Four studies had a greater proportion of dropouts in the parent-only group compared with control.<sup>18,19,21,22</sup> Each study reports of at least one participant-stated reason for dropout. Most frequent reasons are health issues (in four studies), time commitment (in four studies), refusal of the allocated group (in 3 studies) and lack of motivation (in two studies). Munsch *et al.*,<sup>21</sup> who experienced the

highest dropout rate, observed that mothers missing after 6 months were significantly younger ( $P = 0.008$ ) and they also commented that their choice to use PMR training with control children from the parent-only arm 'might have disappointed and discouraged children' indicating that study design may have been an issue in the high dropout.

#### Within-group analysis for the parent-only arm

Table 2 also shows the within-group differences. In all studies, children of the parent-only groups have experienced a reduction in the degree of overweight, albeit the response over time varied by study. Studies showing that the reduction increased over time were from Golan *et al.*, which showed a significant decrease in percent overweight of 14.6% over 12 months,<sup>17,23</sup> which dropped further 1, 2 and 7 years later, reaching a change of 29%.<sup>24</sup> In another trial, Golan *et al.*<sup>18</sup> have found a significant reduction in percent overweight and BMI Z-score over an 18-month period. Following up children over 11 months, Boutelle *et al.*<sup>19</sup> also detected a continuous drop in BMI percentile, although significance was not tested. The promising drop of BMI Z-score in Janicke *et al.*'s study after 4 months ( $-0.139$ ) was however opposed by a rebound at Month 10 ( $-0.091$ ). No within-group statistical significance was reported. One year after baseline, Okely *et al.*<sup>22</sup> measured a mean change of BMI Z-score of  $-0.39$  (95% CI  $-0.51$ ,  $-0.27$ ), which was maintained at the 2-year follow-up at  $-0.35$  (95% CI  $-0.48$ ,  $-0.22$ ).<sup>26</sup>

#### Secondary outcomes

Change in parental BMI, or other weight-related measures, was reported by five studies.<sup>17–21</sup> The study by Golan *et al.*<sup>17</sup> reported a significant decrease in the percentage overweight of fathers at 12-months following the parent-only



**Table 2** Results with regard to children's obesity related outcome

Study; measures of overweight	Within group, parent only	Within group, child only	Within group, parent and child	Between groups	Overall 'between-group' results	Lost-to-follow-up/ dropout (%) from intervention
Golan et al. <sup>17</sup> Golan et al. <sup>23</sup> Golan and Crow <sup>24*</sup> %-overweight = $100 \times (\text{actual weight} - \text{BMI 50th percentile}) / \text{BMI 50th percentile}$	Month 12: – 14.6%; $P < 0.001$ Month 24*: – 13.6%; $P < 0.05$ Month 36*: – 15%; $P < 0.01$ Month 96*: – 29%; $P < 0.05$	Month 12: – 8.1%; $P < 0.01$ Month 24*: 0%; $P < 0.05$ Month 36*: + 2.9%; $P < 0.01$ Month 96*: – 20.2%; $P < 0.05$	n/a	$F_{1,47} = 5.0$ ; $P < 0.05$ (greater reduction in PO) Month 96*: $F = 64.5$ ; $P < 0.000$ Time $\times$ group interaction*: $F = 6.9$ ; $P < 0.000$	Significantly greater weight loss in children of PO group compared with CO group	Randomization—month 12: PO: 1/30 (3%) CO: 9/30 (30%)
Golan et al. <sup>18</sup> %-overweight = (current BMI – BMI 50th percentile)/BMI 50th percentile $\times 100$	Month 6: – 9.5%; $P < 0.05$ Month 18: – 12%; $P = 0.045$	n/a	Month 6: – 2.4%, n.s. Month 18: + 0.4, n.s.	Month 6: $F_{(1,28)} = 11.3$ ; $P = 0.02$ Overall change over time (0,6,18 months): $F_{(2,56)} = 10.7$ ; $P < 0.01$ Group $\times$ time interaction: $F_{(2,56)} = 7.5$ ; $P = 0.001$	PO intervention showed significantly better change in overweight than PC intervention.	Randomization—month 6: PO: 4/14 (29%) PC: 1/18 (6%)
BMI Z	Month 6: – 0.4; $P = 0.003$ Month 18: – 0.5; $P = 0.025$		Month 6: – 0.1; n.s. Month 18: + 0.1; n.s.	Month 6: $F_{(1,28)} = 5.7$ ; $P = 0.024$ Overall change over time (0,6,18 months): $F_{(2,56)} = 5.9$ ; $P = 0.005$ Group $\times$ time interaction: $F_{(2,56)} = 3.9$ ; $P = 0.02$		
Munsch et al. <sup>21</sup> %-overweight = (effective BMI/BMI 50th percentile) – 1	6-month follow-up: – 4.52%; $P < 0.001$	n/a	6-month follow-up: – 1.91%; $P < 0.001$	Interaction linear trend $\times$ treatment: $P = 0.43$ Quadratic trend $\times$ treatment: $P = 0.83$	Both PO and PC effective at reducing overweight. No difference between the groups (equivalent)	Randomization—month 6: PO: 18/25 (72%) PC: 11/31 (35%)
Janicke et al. <sup>20</sup> BMI Z	Mean (SD) Month 4 – 0.139 (0.19) Month 10: – 0.091 (0.20) (no within-group statistical significance presented)		Mean (SD) Month 4: – 0.078 (0.16) Month 10: – 0.115 (0.22) (no within-group statistical significance presented)	Mean difference (95% CI) Month 4: PO–WLC: 0.127 (0.027, 0.226); $P < 0.05$ PC–WLC: 0.065 (–0.027, 0.158); $P = 0.16$ PO–PC: 0.061 (–0.039, 0.162); $P = 0.23$ Month 10:	PO and PC are statistically both better than WLC at 10 months follow-up. Similar change for PO and PC conditions.	Randomization—month 10: PO: 8/34 (24%) PC: 9/33 (27%) WLC: 5/26 (19%)

Okely <i>et al.</i> <sup>22</sup> Collins <i>et al.</i> <sup>26*</sup> BMI Z mean (95% CI)	Month 12: −0.39 (−0.51, −0.27)	Month 12: −0.17 (−0.28, −0.06)	Month 12: −0.32 (−0.42, −0.22)	PO–WLC: 0.115 (0.003, 0.220); <i>P</i> = 0.04 PC–WLC: 0.136 (0.018, 0.254); <i>P</i> = 0.03 PO–PC: <i>P</i> = 0.68 Mean reduction (95% CI)	All groups show significant reduction in BMI Z-score at 12 and 24 months.	Randomization— baseline: PO: 21/63 (33%) PC: 10/70 (14%) CO: 10/73 (14%)
	Month 24*: −0.35 (−0.48, −0.22)	Month 24*: −0.19 (−0.30, −0.07)	Month 24*: −0.24 (−0.35, −0.13)	Month 12: PO–CO: −0.22 (−0.38, −0.06) PC–CO: −0.15 (−0.29, 0.00) PC–PO: 0.07 (−0.08, 0.23) Month 24*: Group × time difference ( <i>P</i> = 0.04) PO–CO: −0.17 (−0.34, 0.01) PC–CO: −0.05 (−0.21, 0.11) PC–PO: 0.11 (−0.06, 0.28) Month 12: Group × time interaction −0.24 cm (−0.34, −0.15), <i>n.s.</i>	PO (diet) and PC (diet and physical activity) groups better than CO (physical activity) at 12 and 24 months (double the reduction in BMI-Z score). PC and PO not statistically different between groups	Baseline—month 24*: PO: 20/42 (48%) PC: 24/60 (40%) CO: 28/63 (44%) (only participants who completed baseline were included in analysis)
Waist circumference						
Boutelle <i>et al.</i> <sup>19</sup> BMI Percentile	Month 0: 98.37 (1.85), <i>n</i> = 40 Month 5: 96.82 (5.49), <i>n</i> = 24 Month 11: 95.08 (11.18), <i>n</i> = 24 (no tests of significance)	<i>n/a</i>	Month 0: 98.34 (1.37), <i>n</i> = 40 Month 5: 97.21 (2.75), <i>n</i> = 28 Month 11: 97.23 (3.01), <i>n</i> = 28 (no tests of significance)	Mean reduction (s.e.) 90% CI Month 5: −0.500 (0.680) − 1.619, 0.619 Month 11: −2.316 (1.574) − 4.905, 0.273	Non-inferiority of PO to PC on child weight changes	Randomization—month 6: PO: 16/40 (40%) PC: 12/40 (30%)

intervention (baseline: 30.1% versus 12 months: 25.7%,  $t = 2.42$ ,  $P < 0.05$ ), but no significant change in the child-only intervention. There was a significant difference between groups in favour of the parent-only intervention ( $F = 3.62$ ,  $P < 0.05$ ).<sup>17</sup> However, no other studies showed within-group or between-group changes.

Change in children's energy intake was reported by four studies, reporting equivocal findings.<sup>17,19,20,26</sup> Between-group differences were reported by Golan *et al.*<sup>17</sup> in favour of a greater reduction of calories in the parent-only group (versus child-only); Boutelle *et al.*<sup>19</sup> found in favour of parent-child (versus parent-only) who could not support non-inferiority, whereas Collins *et al.*<sup>26</sup> and Janicke *et al.*<sup>20</sup> both reported no significant between-group differences.

Family eating habits were shown to be better in the parent-only group compared with the child-only group with regard to the presence of unhealthy foods in the home, the child taking and buying snacks without permission and the eating style.<sup>17</sup> However, when a parent-only intervention was compared with a parent-child intervention, the difference between groups for the presence of unhealthy foods in the home remained the only significant difference between groups, in favour of the parent-only intervention.<sup>18</sup> Change in children's physical activity levels was not different between parent-only and parent-child groups<sup>18,19,26</sup> and between parent-only and child-only groups.<sup>17,26</sup>

Only one paper reported mental health outcomes, which showed no group differences in behaviour, depressive feelings and anxiety in children between parent-only and parent-child interventions, whereas depressive feeling in mothers was significantly reduced in the parent-only group compared with parent-child group.<sup>21</sup> One study reported metabolic outcomes in children, which were broadly similar for parent-only, child-only and parent-child groups.<sup>22</sup>

### Study characteristics of ongoing RCTs

Two protocols (Table 1) for ongoing RCTs were identified, both of which are from the USA and are definitive studies following the results from two RCTs already reported in this review,<sup>19,20</sup> now with larger sample sizes, longer follow-up periods and cost-effectiveness analyses. The first by Janicke *et al.*<sup>16</sup> is a protocol for an RCT entitled 'Extension Family Lifestyle Intervention Project (E-FLIP for Kids)'. This study has three arms, aiming to compare a family-based with a parent-only intervention and an education control condition in 240 overweight or obese children aged 8–12 years, measuring BMI Z-score as well as cost-effectiveness up to 24-months follow-up. The second protocol<sup>15</sup> presents a study entitled 'Parents as the Agents of Change for Childhood

Obesity (PAAC)' with 150 overweight 8–12 year-old children, aimed at evaluating the effectiveness and cost-effectiveness of parent-only versus parent-child behavioural treatment on the child's BMI Z-score, up to 18-months follow-up. Results are expected in 2015.

### Programme costs

One of the six completed studies also considered the costs of delivering the interventions.<sup>25</sup> They compared the programme costs that arose for the parent-only intervention with the costs for the parent-child intervention, for personnel, materials, incentives, food and travel for staff and families. While the effectiveness of the parent-only intervention did not differ significantly from that of the parent-child intervention, the parent-only intervention was cheaper. The costs per child were 63% higher in the parent-child group compared with the parent-only group (parent only \$521 versus parent-child \$872), and 31% higher per unit change in weight status (0.1 decrease in BMI Z-score) (parent only \$579 versus parent-child \$758).

## Discussion

### Main findings of this study

This study set out to determine whether parent-only interventions are effective in the treatment of obesity in children aged 5–12 years compared with child-only or parent and child interventions. In total, 8 studies (from 12 papers) met the inclusion criteria for the review, of which 6 were completed studies and 2 were protocols for ongoing trials.

While two studies showed an increased reduction in the degree of overweight in the parent-only groups compared with parent-child and child-only interventions, the other four studies' results suggest that parent-only interventions are at least as good as parent-child interventions with regard to their effectiveness in the treatment of childhood obesity. None of the studies showed that parent-only interventions were less effective in weight management in children.

High dropout rates are common in weight management programmes and can vary widely depending on the definition.<sup>32,33</sup> Parent-only interventions could be expected to show lower dropout rates as it may be easier for parents to plan attendance. However, we found that the overall trend was for parent-only interventions to experience higher dropouts from the intervention. In addition to participants' reasons for dropping out, it could be argued that taking up the responsibility for their child's healthy weight may be overwhelming and lead to higher dropouts in the parent-only groups.<sup>21,24</sup> Thus, parents who participate in parent-only programmes need strong motivation

but also the support of extended family that should not undermine the efforts of the lead parent.<sup>34</sup> Furthermore, parents may prefer their child to be involved, perhaps preferring another adult to teach weight management skills to their child and their child to have the support from other overweight children.<sup>19</sup> Previously identified influencing factors on childhood obesity intervention dropout, e.g. ethnicity, socio-economic status, child age and baseline BMI,<sup>35,36</sup> were not assessed as predictors for dropout in our included studies.

Having established that parent-only interventions appear to be as good as parent-child (family-based) interventions, the assumption must be explored that parent-only interventions are likely to be more cost-effective. Only one of the six published studies in this review also considered programme costs<sup>20</sup> and showed that parent-only interventions are cheaper to run than interventions including both parents and children—with lower costs per unit change in BMI Z-score. However, the authors did not perform a full economic evaluation. Costs to run a family-based programme will depend on whether parents and children attend together or in separate groups. For example, in the study examining costs by Janicke *et al.*,<sup>25</sup> the parent-child intervention was delivered to separate parallel groups for children and parents. This design would likely be more costly to deliver on rooms and facilitators than if the parents and children had attended a single group. Further studies are needed to examine both intervention costs and costs from a health care and societal perspective.

### What is already known on this topic

Family-based interventions have been shown to be effective and are considered as the current best practice in the treatment of childhood obesity,<sup>9</sup> although increased attention is being paid to parent-focused interventions. Our findings concur with those identified in a recent review suggesting that parent-only interventions might have a similar effect as parent-child interventions for weight loss in children.<sup>12</sup>

### What this study adds

This review includes the most up to date literature on parent-only versus parent-child or child-only interventions in the treatment of childhood obesity. As such, it adds to the findings of a recent systematic review<sup>12</sup> which only compared parent-child approaches to weight loss. Our review shows that parent-only groups are at least as effective as child-only or parent-child interventions. Our inclusion of a greater number of papers, as well as ongoing studies and those related to costs has highlighted where current evidence is lacking. We also explored the secondary outcomes reported the papers. As such, we identify several areas for future research: first, a need to conduct cost-effectiveness analyses

alongside effectiveness analyses to identify whether parent-only interventions are more cost-effective than parent-child interventions. The two ongoing RCTs identified in this review are including cost-effectiveness analyses, and we await their findings.<sup>15,16</sup> Secondly, although all studies were conducted in high-income countries, none of the studies took place in the UK and so it is not clear how generalizable the findings are. Therefore, studies in the UK focusing on parent-only interventions to treat overweight children are warranted. Thirdly, in light of concerns regarding dropout, qualitative research may prove beneficial in understanding the complexities behind attendance in parent-only interventions. Fourthly, secondary outcomes indicated that the absence of the child is not detrimental, whereas some studies indicated that parent-only interventions lead to better mental health in parents,<sup>21</sup> weight status in fathers<sup>17</sup> and some improvement in family eating habits.<sup>17,18</sup> This needs further exploration in the future.

### Limitations of this study

A limitation of the study is that due to the heterogeneity of the outcome data, a meta-analysis was not conducted. A meta-analysis would have added to the validity and overall statistical significance of the findings.<sup>13</sup> While Jull and Chen<sup>12</sup> included a meta-analysis in their review, only one study published enough data for inclusion,<sup>20</sup> with unpublished data being provided by the study authors. Our identification of ongoing studies suggests that this is still an important area under investigation, and as such future results will add to the evidence base, allowing potential for updated meta-analyses. Other limitations of the review are that the studies included in this review were generally small and at some risk, or unclear risk of bias, which was mostly associated with non-reporting or under-reporting of risk of bias domains. The results should be interpreted with this in mind.

### References

- 1 WHO. Obesity and overweight. Fact Sheet No. 311, 2011. <http://www.who.int/mediacentre/factsheets/fs311/en/index.html> (8 March 2012, date last accessed).
- 2 Reilly JJ, Methven E, McDowell ZC *et al.* Health consequences of obesity. *Arch Dis Childhood* 2003;**88**:748–52.
- 3 WHO. *Obesity: Preventing and Managing the Global Epidemic*. Geneva: World Health Organization, 1998.
- 4 Lobstein TJ, James WPT, Cole TJ. Increasing levels of excess weight among children in England. *Int J Obes* 2003;**27**:1136–8.
- 5 Stamatakis E, Wardle J, Cole TJ. Childhood obesity and overweight prevalence trends in England: evidence for growing socioeconomic disparities. *Int J Obes* 2010;**34**:41–7.

- 6 NHS Information Centre. *Statistics on Obesity, Physical Activity and Diet*. UK: Health and Social Care Information Centre, 2013. <https://catalogue.ic.nhs.uk/publications/public-health/obesity/obes-phys-acti-diet-eng-2013/obes-phys-acti-diet-eng-2013-rep.pdf> (19 September 2013, date last accessed).
- 7 Harker R. Statistics on Obesity, 2011. <http://www.parliament.uk/briefing-papers/SN03336> (8 March 2012, date last accessed).
- 8 DH. *Healthy Lives, Healthy People: A Call to Action on Obesity in England*, 2011. [http://www.dh.gov.uk/prod\\_consum\\_dh/groups/dh\\_digital\\_assets/documents/digitalasset/dh\\_130487.pdf](http://www.dh.gov.uk/prod_consum_dh/groups/dh_digital_assets/documents/digitalasset/dh_130487.pdf) (30 August 2012, date last accessed).
- 9 Luttikhuis HO, Baur L, Jansen H *et al*. Interventions for treating obesity in children. *Cochrane Database Syst Rev* 2009.
- 10 Waters E, de Silva-Sanigorski A, Hall BJ *et al*. Interventions for preventing obesity in children. *Cochrane Database Syst Rev* (Online) 2011;**12**:CD001871.
- 11 Upton D, Upton P, Bold J *et al*. Regional evaluation of weight management programmes for children and families, 2012. [http://www.obesitywm.org.uk/resources/Worcester\\_Report\\_Fina.pdf](http://www.obesitywm.org.uk/resources/Worcester_Report_Fina.pdf) (19 September 2013, date last accessed).
- 12 Jull A, Chen R. Parent-only versus parent-child (family-focused) approaches for weight loss in obese and overweight children: a systematic review and meta-analysis. *Obes Rev*, 2013 (in print). Article first published online (3 May 2013, date last accessed).
- 13 CRD. *Systematic Reviews: CRD's Guidance for Undertaking Reviews in Health Care*. York: CRD, University of York, 2009.
- 14 Higgins JPT, Green S. *Cochrane Handbook for Systematic Reviews of Interventions*. Oxford: Cochrane Collaboration, 2011. <http://www.cochrane-handbook.org/> (16 May 2012, date last accessed).
- 15 Boutelle KN, Cotton M. Parents as the agent of change for childhood obesity (PAAC)\_NCT01197443. Ongoing. <http://clinicaltrials.gov/ct2/show/NCT01197443> (15 May 2013, date last accessed).
- 16 Janicke DM, Lim CS, Perri MG *et al*. The Extension Family Lifestyle Intervention Project (E-FLIP for Kids): design and methods. *Contemp Clin Trials* 2011;**32**:50–8.
- 17 Golan M, Weizman A, Apter A *et al*. Parents as the exclusive agents of change in the treatment of childhood obesity. *Am J Clin Nutr [serial on the Internet]* 1998;**67**(6). <http://www.mrw.interscience.wiley.com/cochrane/clcentral/articles/597/CN-00151597/frame.html> (24 July 2012, date last accessed).
- 18 Golan M, Kaufman V, Shahar DR. Childhood obesity treatment: Targeting parents exclusively v. parents and children. *Br J Nutr* 2006;**95**:1008–15.
- 19 Boutelle KN, Cafri G, Crow SJ. Parent-only treatment for childhood obesity: A randomized controlled trial. *Obesity* 2011;**19**:574–80.
- 20 Janicke DM, Sallinen BJ, Perri MG *et al*. Comparison of parent-only versus family-based interventions for overweight children in underserved rural settings: outcomes from Project STORY. *Arch Pediatr Adolesc Med* 2008;**162**:1119–25.
- 21 Munsch S, Roth B, Michael T *et al*. Randomized controlled comparison of two cognitive behavioral therapies for obese children: Mother versus mother-child cognitive behavioral therapy. *Psychother Psychosom* 2008;**77**:235–46.
- 22 Okely AD, Collins CE, Morgan PJ *et al*. Multi-site randomized controlled trial of a child-centered physical activity program, a parent-centered dietary-modification program, or both in overweight children: the HIKCUPS study. *J Pediatr [serial on the Internet]* 2010;**157**(3). <http://www.mrw.interscience.wiley.com/cochrane/clcentral/articles/016/CN-00760016/frame.html> (23 July 2012, date last accessed).
- 23 Golan M, Fainaru M, Weizman A. Role of behaviour modification in the treatment of childhood obesity with the parents as the exclusive agents of change. *Int J Obes Relat Metab Disord* 1998;**22**:1217–24.
- 24 Golan M, Crow S. Targeting parents exclusively in the treatment of childhood obesity: long-term results. *Obes Res* 2004;**12**:357–61.
- 25 Janicke DM, Sallinen BJ, Perri MG *et al*. Comparison of program costs for parent-only and family-based interventions for pediatric obesity in medically underserved rural settings. *J Rural Health* 2009;**25**:326–30.
- 26 Collins CE, Okely AD, Morgan PJ *et al*. Parent diet modification, child activity, or both in obese children: An RCT. *Pediatrics* 2011;**127**:619–27.
- 27 Piaggio G, Elbourne DR, Altman DG *et al*. Reporting of noninferiority and equivalence randomized trials: An extension of the CONSORT statement. *J Am Med Assoc* 2006;**295**:1152–60.
- 28 Golan M. Parents as agents of change in childhood obesity—from research to practice. *Int J Pediatr Obes* 2006;**1**:66–76.
- 29 Nuesch E, Trelle S, Reichenbach S *et al*. Small study effects in meta-analyses of osteoarthritis trials: meta-epidemiological study. *BMJ* 2010;**341**:c3515.
- 30 Sterne JAC, Egger M, Smith GD. Systematic reviews in health care: Investigating and dealing with publication and other biases in meta-analysis. *Br Med J* 2001;**323**:101–5.
- 31 Sterne JAC, Gavaghan D, Egger M. Publication and related bias in meta-analysis: Power of statistical tests and prevalence in the literature. *J Clin Epidemiol* 2000;**53**:1119–29.
- 32 Eneli IU, Cunningham A, Woolford SJ. The pediatric multidisciplinary obesity program: an update. *Prog Pediatr Cardiol* 2008;**25**: 129–36.
- 33 Warnick EM, Gonzalez A, Robin Weersing V *et al*. Defining dropout from youth psychotherapy: how definitions shape the prevalence and predictors of attrition. *Child Adolescent Mental Health* 2012;**17**:76–85.
- 34 Stewart L, Chapple J, Hughes AR *et al*. Parents' journey through treatment for their child's obesity: a qualitative study. *Arch Dis Childhood* 2008;**93**:35–9.
- 35 Karlson CW, Rapoff MA. Attrition in randomized controlled trials for pediatric chronic conditions. *J Pediatr Psychol* 2009;**34**:782–93.
- 36 De Niet J, Timman R, Jongejan M *et al*. Predictors of participant dropout at various stages of a pediatric lifestyle program. *Pediatrics* 2011;**127**:e164–e70.

## Appendix: Search strategy MEDLINE

Medline Search for PO versus PC SR, 3 March 2013

## # Search terms

- 1 (childhood or children).mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]
- 2 Child.mp. or Child/
- 3 1 or 2
- 4 adiposity.mp. or Adiposity/
- 5 (overweight or obese).mp. [mp = title, abstract, original title, name of substance word, subject heading word, keyword

heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier]

- 6 exp Obesity/ or obesity.mp.
- 7 4 or 5 or 6
- 8 Limit 3 to ('child (6–12 years') or 'adolescent (13–18 years')
- 9 parent.mp. or Parents/
- 10 parenting.mp. or Parenting/
- 11 9 or 10
- 12 7 and 8 and 11
- 13 Limit 12 to (clinical trial, all or randomized controlled trial)
- 14 Limit 13 to yr = '1990 -Current'